A changing spatial scene of innovation

van Geenhuizen, M.; Nijkamp, P.

2002

Faculteit der Economische Wetenschappen en Bedrijfskunde

SERIE RESEARCH MEMORANDA

A Changing Spatial Scene of Innovation

Marina van Geenhuizen
Peter Nijkamp

Research Memorandum 2002-12

March 2002

vrije Universiteit amsterdam

A Changing Spatial Scene of Innovation

Marina van Geenhuizen
Technische Bestuurskunde
Technische Universiteit Delft
Postbus 50 15
2600 GA Delft

Peter Nij kamp
Dept. of Spatial Economics
Free University
De Boelelaan 1105
1081 HV Amsterdam

PN015MvG

1. Introduction

Regional development is governed by dynamic forces inside the region, in particular innovative behaviour of regional and urban actors. In the history of regional and urban innovation analysis over the past decades we have witnessed a shit? in attention from *regional technogenesis* to *urban technogenesis*, and next to *virtual technogenesis*. There has been a concomitant shift in emphasis from physical and institutional features (e.g. seedbed conditions) and agglomeration advantages of various kinds, to virtual network connectivity and learning capability. At the same time, the perspective on innovation has widened from product and process innovation to a more comprehensive approach, also including market innovation and organisational innovation, and the firms' strategic context. What has also changed is the perception of innovation, i.e. from a linear process to a much more complex process including iterations and loops, and different players in networks with universities, customers, suppliers, etc. aside from the firm. These changes reflect not only the endeavour to come to a deeper understanding of the spatial differentiation in innovation, but also the actual changes in practice and context of innovation, like the (partial) move from Fordist to flexible production, the increasing network character of learning, and the increased use of the Internet and other electronic means in business transactions and information gathering.

2. Seedbed Conditions and Knowledge Base

Regional technogenesis refers to the physical and institutional regional features that support and create new technological advances. Research on regional incubators and regional seedbed conditions is illustrative for this approach (see e.g. Davelaar 1992; Kleinknecht and Poot 1992; Oakey et al. 1980). Much of this research draws on the classica1 incubation and filter-down hypotheses, and on the more recent but related concept of innovation cycle. In the "dynamic incubation theory" metropolitan areas are conceived as the breeding place of innovative activities and new firms based on product innovation. Technological change as a continuous process acts then as a driving force behind a spatial shift (spread) fi-om the economic core to intermediate regions and border areas, where the emphasis is on process innovation.

With the advent of the information and telecommunication (ICT) sector more emphasis has been placed on the *urban* potential in favouring new and innovative activities. An important element in the emerging new popularity of the city is the recognition of one of the fundamentals of city formation, viz. agglomeration advantages of various kind (see e.g. Glaeser 1999; Vass 2001). Despite negative extemalities, the city offers stil1 a unique portfolio of opportunities and benefits of both a physical and intangible nature, which are hard to compete with. Due to their sheer market size large cities are able to continuously improve their position in global telecommunication grids (Graham 1999).

Since the 1970s the awareness has grown that a competitive position of localities is contingent on their *knowledge base*. First, there was an emphasis on the model of knowledge production function, where firms combine knowledge inputs to generate innovative output. This was followed by a shift to models of knowledge spillovers as economies of scale in the process of innovation in particular places (e.g. Audretch 1998). Localised knowledge spillovers are based on transmission of tacit knowledge in an urban environment where people are the most important carriers, i.e. people that meet each other informally and frequently through face-to-face contacts, and people that are highly mobile in the labour market. Knowledge not only spills over from firm to firm but also fi-om research institutions and universities to firms (e.g. Jaffe et al. 1992; Audretch and Feldman 1996). This recognition has prompted a shift in research from firms as the unit of observation to firms' networks and agents of spillovers.

In broader knowledge approaches, knowledge does not only refer to academic knowledge, but to the whole intellectual and informational resource base in urban areas and comprises universities, higher education institutes, private and public research laboratories, training facilities and the like. In this context we observe the emergence of new creative concepts for the urban future as witnessed inter alia by the following nomenclature: the knowledge city, the intelligent city, the informational city, the know-how city, the science city or the 3-C (communication, creativeness, culture) city. The current scientific interest in endogenous growth has put knowledge, education, training, skills, research and information in the centre of science policy and innovation analysis in both the public and the private sector (see Bennett et al. 2000). We witness also a burgeoning interest in the process through which knowledge as an

intellectual resource of a social nature is shaped and shared (Brouwer et al. 1999; Curran and Blackbum 1994). In this context, the notion of a *learning region*, a *learning city*, or a *learning decision-maker* has gained much popularity. Human resource management, knowledge creation and evolution, social and institutional knowledge networks, and innovation culture have become focal points of modem growth policy in the knowledge society (see also Amin and Cohendet 1999; Román 2000). All these factors are essential in shaping the competitive base of cities and regions.

3. Innovative Milieux and Regional Innovation Systems

The new framework of innovation and knowledge creation calls for appropriate scientific analysis tools, in which regional and urban development theory is complemented with organisational leaming theories, evolutionary thinking on neo-Schumpeterian behaviour, and social-legal theories on trust, leaming behaviour, social co-operation and social-spatial association (see also Antonelli 1995; Batten 1995; Camagni 1991; Cooke and Morgan 1993; Fischer and Fröhlich 2001; Knight 1995; Lundvall 1992; Nijkamp and Reggiani 1999; Storper 1996). In this vein we have seen the rise of regional concepts like "innovative milieu" and "regional innovation systems". In the "innovative milieux" approach the firm is viewed within its local (regional) context and the focus of analysis is on the way this environment contributes to the rise of new firms and the adoption of innovation by established firms. Characteristics of innovative firms themselves are also subject of analysis, like firm strategies, size of firms and the way they are organised, i.e. vertically or horizontally (e.g. Maillat et al. 1993; Saxenian 1994).

Nowadays, the "innovative milieu" approach adopts a more explicit dynamic perspective in which the key parameters of changes in innovativeness over time are explored (Bramanti and Senn 1997; Ratti et al. 1997). Most recently this is the case within a broader development perspective using the "active space approach" (van Geenhuizen and Ratti 2001). Urban and regional development here is perceived as the outcome of openness (or integration), creative ability of local (regional) actors and their concern for sustainability; the latter in a broad sense of environmental norms, economic and socio-cultural norms.

The idea behind the concept of "innovation systems" is that innovativeness of sectors and firms not only depends on individual innovative efforts of firms and R&D organisations, but also on how these actors interact with each other and how governments, through investment and regulation etc., support the production and distribution of knowledge, e.g. through universities (e.g. Lundvall 1992; Conceição and Heitor 1999). In the "regional innovation systems" approach, it is acknowledged that national innovation systems may work differently in different regions, particularly cumulative leaming processes. These processes are conceived as dependent on a different diversity of knowledge sources and geographical proximity. The latter factor facilitates cumulative leaming, but only if other requirements of proximity are satisfied, such as organisational and cultural proximity. The approach of "regional innovation systems" (Braczyk et al. 1998) is also clearly inspired by the rise of "regional production systems", based on the so-called Post-Fordist production organisation, and "industrial clusters". Large, vertically organised, corporate structures have given way to much more flexible organisational structures and ways of production, both in terms of customised production and outsourcing relationships with suppliers, and in terms of labour relations. In this vein, firms tend to seek close geographical proximity, mainly because of the localised transfer of tacit knowledge, a pool of specialised workers and suppliers, and access to institutions and public goods. Local rivalry, peer pressure, and the desire to perform good in the community spur firms in clusters to remain competitive and innovate (Porter 1998). There is also another side of the coin of the cluster phenomenon. Much less attention is given to factors that cause a downturn in innovativeness of "clusters" of firms, based on the emergence of disadvantages of some cluster dynamics over time.

In the context of clusters, innovative milieux, etc., active research attention is now being paid to the concept of "institutional thickness". This is based on the recognition of the above approaches that innovation is not an act merely by private firms but very much also by a whole array of other organisations, public and private ones (Amin and Thrift 1994). These organisations provide or support to develop new technology and supply an array of specialist business services. Based on insights from social network theories (Grabher, 1993), the formal networks involved are embedded in local, informal, relationships among experts and specialists. Informal networks derive their

nature from local habits and rules, and flourish through venues where face-to-face contacts provide opportunities to establish and refresh trust, and to make judgements about the quality of knowledge and expertise. Thus, "institutional thickness" and local embeddedness strongly support innovation in space.

4. Back to the Region hut Now an Extended Urban Region

The above sketched developments prompt also a re-orientation of our views on the space-economy. Different visions are developed, ranging from a footloose economy with firms and households operating in global networks (the 'death of distance'; see Caimcross 1997) to a reinforcement of urban agglomerations (acting as 'global command centres'; see Sassen 1996). In this context, Graham and Marvin (1997) give a critical survey of the approaches to study the relation between city development and telecommunications, and wam against various deterministic views.

In the vein of the discussion on new urban roles and profiles the concept of the *network* society was conceived (see Castells 1996). This concept refers to an organised structure of human activity which manifests itself as an interconnected system of functional cores and related links in regions of different geographical architecture. In this new organisational constellation the region and the city become a kemel in a broad – sometimes global – network. The emphasis is less on physical distance, but more on *virtual connectivity*. In this context, it is interesting to note that at the leve1 of firms we observe recently the rise of so-called 'networked incubators' which provide newly established (internet)firms with structured networks. These, partly virtual, networks enable newly established firms to attract resources and connect with partners much quicker and cheaper – due to scale advantages – than in conventional ways (Hansen et al. 2000). In fact, such types of networks provide the advantages of the scale and global reach of large established firms, aside from the entrepreneurial spirit of newly established firms.

It goes without saying that much innovative research is needed to understand the driving forces and spatial implications of our current knowledge-based economy, in which urban areas are prominently present. It is, therefore, no surprise that urban rejuvenation based on creative network concepts appears to be a major focal point of

research and policy. In this context, a reference is often made to a new type of Marshallian district, in which the city plays a centra1 role. But in contrast to the past, there are two obvious differences. In the first place, the emphasis is less on industrial innovation, but rather on knowledge creation and diffusion. Against this background perspective, Marshallian districts turn into knowledge districts, with largely the same economic meaning as previous creative business districts. In the second place, the knowledge-based city becomes a nodal point in a multi-layer, regional-national-global network. An extensive illustration of this phenomenon is given by Leyshon and Thrift (1997) and Porteous (1999), in their study of financial services. The typical hinterland of the modem city – spreading its information and knowledge to other places – is often the whole world. Cities become intemational exchange cores in a complex network govemed by interaction, communication and association. From this perspective, the concept of an *'associative city '* is becoming 'en vogue'.

Furthermore, city domains are no longer physically limited to the urban centres, but are covering metropolitan areas (including edge cities) and poly-nuclear urban configurations (e.g. Duranton 1999; Kloosterman and Musterd 2001; Lambooy 1998). In general, innovative activities appear to grow in such a new economic-geographical constellation. The region is then back on the scene, but mainly as a spatial support system reinforcing the nodal function of broadly-based urban areas. But it does so in a long-term evolutionary context.

5. Evolutionary Approaches

Although the above discussed approaches of the "leaming region" and "regional innovation systems" clearly adopt evolutionary principles, we discuss evolutionary approaches here separately to pinpoint their characteristics in the conceptualisation of innovation in space. These characteristics can, in fact, be very different, dependent on the perspective taken. For example, it is recognised that new variety in an environment is strongly influenced by the existing or past environment (Boschma and Lambooy 1999). The main reason is that most firms and other organisations tend to conduct routine, particularly risk-aversive, behaviour in view of the uncertainties that arise. In fact, the range of options of firms for new behaviour is strongly restricted by decisions in the recent past, which have led to certain experiences and certain

investments (bounded trajectories). Related is the idea of increasing returns, which explains why a technology that once has taken the lead in the market tends to reinforce this leading position. In addition, the selection environment tends to work as a filtering mechanism deciding which innovation is bound to fail or to become a success. These limiting situations, however, do not prevent that unpredictable and "chance effects" occur, through which new variety may enter the system. The lack of variety is emphasised by some authors, the "chance effects" and new variety are emphasised by others.

Further, if applied to complex spatial systems, an evolutionary approach allows for analysis of adjustments of these systems to the outer world and of system characteristics that enable a smooth and incremental adjustment or, by contrast, causes dramatic changes. In fact empirical knowledge in this respect is very limited, because the system is moved on the basis of complex feed back phenomena, accumulation, network extemalities, increasing returns, etc, all nonlinearities which generate many different outcomes of the system (Camagni 1998). Chaos theory and bifurcation theory, and various concepts of self-organisation enter the scene here (see for details and a survey Nijkamp and Reggiani 1992). What seems relevant in an empirical investigation is the rise of "development blockages" which after some time urge systems to take a new and often dramatic change, i.e. circumstances like the absence of dissenting voices, reproducing system culture and preventing strategic creativity at critical points in time (Cooke 1998). In this context, both facilitating factors and spatial impediments – and their evolution in space and time – play a critical role.

6. The Changing Scene of Spatial Innovation Policy

In the 1980s traditional regional policy making came under attack in countries like Great Britain and the Netherlands. Inward investment in economic problem areas did not pay sufficient attention to indigenous development and local potentials, such as local new firm formation, increasing the innovativeness of established firms and induce new growth of smal1 and medium sized enterprises (SMEs) (Armstrong and Taylor 2000). Particularly the renewed attention for innovation, since the late 1970s, has led to various initiatives – both at the national leve1 and local leve1 - to increase

the use of the latest technology among smaller firms. The establishment of national networks of innovation centres and local initiatives for incubator and Science Park development fit into this stream of policy making (Charles 1998; Sternberg 1990). These measures were also taken in depressed areas, aside from the provision of venture capita1 and improved infrastructure provision.

In terms of the policy making process, we have seen a move in the past decades from top-down measures to more bottom-up and participatory approaches and network types of steering, notably in European Union regional policy making (e.g. Corvers 2001; Morgan 1997). Thus, policy plans are made demand-driven, based on a strengthened dialogue between firms, regionally based capabilities and the public sector, leading to a development strategy attuned to the nuances of the regions and their stakeholders. Policy making using existing networks fits into this new approach. Such policy making targets e.g. at strengthening problem-solving capabilities of regional actors, connecting important networks that were previously isolated from each other, and activating regional actors to combine forces and create synergies.

Following the more comprehensive research approaches of innovative milieux, industrial districts and clusters of SMEs, etc. regional policy makers now struggle with two major problems in attempting to implement the models involved (Armstrong and Taylor 2000). First, most of the highly successful industrial districts or innovative clusters are already in prosperous regions. These regions apparently have the best profile for attracting high-technology firms. Disadvantaged regions, in contrast, are facing huge obstacles in making themselves more attractive for SMEs and the latest technologies, a lower education leve1 and lack of entrepreneurship being some of them. The second problem is the gap between outcomes of the above research and the specific advice needed as input for regional policy making. The advice in fact is too diverse, e.g. to develop a set of traditional Marshallian external economies, to develop "institutional thickness" within the region by inserting a whole array of organisations, to promote local networking between firms at the same time that global networking is necessary. In disadvantaged areas, almost all of these building blocks are poorly developed.

Given the limited budgets in regional policy, the above situation calls for answering research questions on the key features of successfùl regions in a very focused way. Questions with high priority are, for example, which are the few key organisations that constitute "institutional thickness", which two or three extemal economies are most important, and in which sequence should these be established (Armstrong and Taylor 2000)? Thus, there is a need for a reinforced research effort of innovation in space, but with a much more limited focus and preferably a cross-comparative design that takes sufficient account of national and regional nuances. Whereas this view is rather optimistic, there are also more pessimistic opinions about the impact of regional policy on innovation. For example, based on evolutionary views one may adhere the idea that the impact of regional policy is only within small confines from a "pre-determined" development path. In this case, the research effort may be concemed with the question of which policy measures enable to trigger "chance effects" and help to move regional development away from "predetermined" paths. NO matter which opinion, optimistic or rather pessimistic, there is stil1 a huge research task ahead of US.

References

Amin, A., and Cohendet, P. (1999) Learning and Adaptation in Decentralised Business Networks, *Environment & Planning D,* 17: 87- 194

Amin, A. and Thrift, N. (1994) Living in the global, in: Amin, A. and Thrift, N. (eds) *Globalization, Institutions and Regional Development in Europe.* Oxford University Press, Oxford, pp. 1-22.

Antonelli, C. (1999) *The Microdynamics of Technological Change,* Routledge, London.

Audretch, D.B. (1998) Agglomeration and the location of innovative activity. *Oxford Review of Economic Policy,* 14: 18-29.

Audretch, D.B. and Feldman, M.P. (1996) R&D spillovers and the geography of innovation and production, *American Economic Review, 86 (3): 630-640.*

Batten, D.F.(1995) Network Cities, *Urban Studies, 32: 3* 13-327

Bennet, R.J., W.A. Bretton, and Robson, P.J.A. (2000) Business Advice, *Regional Studies, 34: 8* 13-328.

Boschma, R.A. and Lambooy, J.G. (1999) Evolutionary Economics and Economic Geography, *Journal of Evolutionary Economics, 9 (4): 4* 11-429.

Bramanti, A. and Senn, L. (1997) Understanding Structural Changes and Laws of Motion of Milieux: A Study on North-Western Lombardy, in Ratti, R., Bramanti, A. and Gordon, R. (eds) (1997) *The Dynamics of Innovative Regions, The GREMI Approach,* Ashgate, Aldershot, pp. 47-73.

Brouwer, E., H. Budil-Nadvomikova, and Kleinknecht, A. (1999) Are Urban Agglomerations a Better Breeding Place for Product Innovation?, *Regional Studies, 33:* 341-349.

Caimcross, F. (1997) *The Death of Distance,* Harvard Business School, Cambridge.

Camagni, R. (ed.) (199 1) *Innovation Networks,* Belhaven, London.

Camagni, R. (1998) Beyond Complexity in Urban Development Studies, in Bertuglia, C.S., Bianchi, G. and Mela, A. (eds) *The City and Its Sciences.* Springer, Heidelberg, pp. 363-385.

Castells, M. (1996) *The Rise of the Network Society,* Blackwell, Oxford.

Charles, D (1998) Regional Support Infrastructures for Smal1 and Medium Sized Enterprises: An International Comparison of Regional Technology and Advisory Centres, in Oakey , R. and During, W. (eds) *New Technology-Based Firms in the 1990s. Volume* 5, Chapman, London, pp. 268-292.

Conceição, P. and Heitor, M.V. (1999) University role. On the role of the university in the knowledge economy. *Science and Public Policy, 26: 37-5* 1.

Cooke, Ph. (1998) Introduction, in: Braczyk, H-J, Cooke, Ph. and Heidenreich, M. (eds) *Regional Innovation Systems.* London, UCL Press, pp. 2-25.

Cooke, Ph., and Morgan, K. (1993) The Network Paradigm, *Society and Space,* 11: *543-564.*

Corvers, F. (2001) European Policies for European Border Regions: An Active Space Approach. In: Geenhuizen, M. van, and Ratti, R. (eds) *Gaining Advantage from Open Borders. An active space approach to regional development.* Aldershot: Avebury, pp. 369-387.

Curran, J., and R. Blackburn (1994) *Smal1 Firms and Local Economic Networks,* Paul Chapman, London.

Davelaar, E.J.(*1992) Regional Economic Analysis of Innovation and Incubation,* Avebury, Aldershot.

Duranton, G. (1999) Distance, land, and proximity: economic analysis and the evolution of cities, *Environment and Planning* A, 3 1: 2 169-2 188.

Fischer, M. and Fröhlich, J. (2001) *Knowledge, Complexity and Innovation Systems,* Springer, Berlin.

Geenhuizen, M. van, and Ratti, R. (eds) (2001) *Gaining Advantage from Open Borders. An active space approach to regional development.* Aldershot: Avebury.

Glaeser, E. (1999) Are Cities Dying? *Journal of Economic Perspectives,* 12, (2): 139-160.

Grabher, *G.* (ed.) (1993) *The embedded firm. On the socio-economics of industrial networks.* Routledge, London.

Graham, S., and Marvin, *S.* (1997) *Telecommunications and the City: Electronic Space, Urban Places.* Routledge, London.

Graham, S. (1999) Global Grids of Glass: On Global Cities, Telecommunications, and Planetary Urban Networks, *Urban Studies, 36 (5): 929-949.*

Hansen, M.T., Chesbrough, H.W., Nohria, N. and Sull, D.N. (2000) Networked Incubators - Hothouses of the New Economy, *Harvard Business Review,* September-October 2000.

Jaffe, A.B., Trajtenberg, M., Henderson, R. (1992) Geographic localization of knowledge spillovers as evidenced by patent citations, *Quarterly Journal of Economics, 63 (3): 577-598.*

Kleinknecht, A. and Poot, A.P. (1992) Do Regions Matter for R&D?, *Regional Studies, 26: 22* 1-232.

Kloosterman, R.C. and Musterd, S. (2001) The Polycentric Urban Region: Towards a Research Agenda, *Urban Studies, 39 (4): 623-633.*

Knight, R. (1996) Kowledge-Based Development, *Urban Studies, 32 (2):* 225-260.

Lambooy, J.G. (1998) Polynucleation and economic development: the Randstad, *European Planning Studies, 6: 457-466.*

Leyshon, A. and Thrift, N.J. (1997) *Money/Space. Geographies of Monetary Trunsformation.* Routledge, London.

Lundvall, B.A. (ed.) (1992) *Nutional Systems of Innovation.* Pinter, London.

Maillat, D. Quévit, M. and Senn, L. (1993) *Réseaux d'innovation et milieux innovateurs: un pari pour le développement régional.* Neuchatel, GREMI/EDES.

Nijkamp, P. and Reggiani, A. (1992) *Interaction, Evolution and Chaos in Space.* Springer, Berlin.

Nijkamp, P. and Reggiani, A. (1999) *The Economics of Complex Spatial Systems.* Elsevier, Amsterdam.

Oakey, R.P., Thwaites, A.T and Nash, P.A. (1980) The Regional Distribution of Innovative Manufacturing Establishment in Great Britain, *Regional Studies,* 14: *235-253.*

Porteous, D. (1999) The Development of Financial Centres: Location, Information Externalities and Path Dependence. In: Martin, R. (ed.) *Money and the Space Economy.* Wiley, Chichester, pp. 95-114.

Porter, M. (1998) Clusters and the New Economics of Competition, *Harvard Business Review,* November-December 1998: 77-90.

Ratti, R., Bramanti, A. and Gordon, R. (eds) (1997) *The Dynamics of Innovative Regions, The GREMI Approach.* Ashgate, Aldershot.

Román, *C.* (ed.) *(2000) Learning to Innovute: Learning Regions.* OECD, Paris and IDR, Sevilla.

Sassen, S. (1996) Cities in a Time of Paradigm Shift, *Proceedings Seoul Metropolitan Forum,* Seoul.

Saxenian, A.L. (1994) *Regional Advantage; Culture and Competition in Silicon Valley and Route 128.* Harvard University Press, Cambridge.

Stemberg, R. (1990) The Impact of Irmovation Centres on Small Technology-Based Firms: The Example of the Federal Republic of Germany, *Smal1 Business Economics, 2:* 105- 118.

Storper, M. (1996) *The Regional World.* Guildford Press, New York.

Vass, *Th.* (2001) *Do Cities Stil1 Matter?* Regional Venture Capita1 Resources. Raleigh, N.C.